SECTION 12 31 00
MANUFACTURED METAL CASEWORK, COUNTERTOPS & ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies metal casework, countertops, related accessories, including base cabinets, wall cabinets, full height cabinets and lab accessories.
B. Items specified in this section:
   1. Laboratory and Hospital Casework:
      1. Fixed Casework
      2. Adjustable Height Mobile Casework
      3. Adjustable Height Shelving
      4. Restraints for Cylinders
      5. Cabinet hardware and accessories.
      6. Laboratory work surfaces.
      7. Laboratory sinks.
      8. Casework accessories.
      9. Water, laboratory gas and electrical service fittings.
      10. Equipment List, For Information Only.

1.2 RELATED WORK

A. Color of casework finish: Section 09 06 00, SCHEDULE FOR FINISHES.
B. Electrical Components: Division 26, ELECTRICAL.

1. Division 05 Section “Metal Fabrications” for slot-channel framing.
2. Division 06 Section “Rough Carpentry” for wood blocking for anchoring laboratory casework.
3. Division 09 Section “Gypsum Board Assemblies” for reinforcements in metal-framed gypsum board partitions for anchoring laboratory casework.
4. Division 09 Sections for wall base material applied to laboratory casework.

5. Division 11 Section 115313 "Laboratory Fume Hoods" for fume hoods, including base cabinets,] countertops and base stands under fume hoods.
6. Division 22, 23, 26 and 27 Sections for installing service fittings specified in this Section, including connecting service utilities.

1.3 PERFORMANCE REQUIREMENTS

A. System Structural Performance: Laboratory casework systems and support framing system shall withstand the effects of the following gravity loads and stresses without permanent deformation, excessive deflection, or binding of drawers and doors:

1. Support Framing System: 600 lb/ft. (900 kg/m)
2. Suspended Base Cabinets (Internal Load): 160 lb/ft. (240 kg/m)
3. Work Surfaces (Including Tops of Suspended Base Cabinets): 160 lb/ft. (240 kg/m)
4. Wall Cabinets (Upper Cabinets): 160 lb/ft. (240 kg/m)
5. Shelves: 40 lb/sq. ft. (200 kg/sq. m)

B. Seismic Performance: Laboratory casework systemsshall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and the requirements of the applicable building code.

1.4 QUALITY ASSURANCE

A. Approval by Contracting Officer of proposed manufacturer, or suppliers, will be based upon submission by Contractor certification that, manufacturer regularly and presently manufactures casework specified as one of their principal products.

B. Installer has technical qualifications, experience, trained personnel, and facilities to install specified items.

C. Furnish supervision of installation at construction site by a qualified technician regularly employed by casework installer.

D. Manufacturer Qualifications: A qualified manufacturer that produces casework of types indicated for this Project that has been tested for compliance with SEFA-8.

E. Source Limitations: Obtain laboratory casework from single source from single manufacturer unless otherwise indicated.
   1. Obtain laboratory casework thru same source and from same manufacturer as fume hoods specified in Division 11 Section "Laboratory Fume Hoods."

F. Casework Product Standard: Comply with SEFA-8 "Recommended Practices for Laboratory Grade Furniture, Casework, Shelving and Tables" for cabinet materials specified.

G. Work Surface Product Standard: Comply with SEFA-3 "Recommended Practices for Laboratory Work Surfaces."

H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

I. Keying Conference: Conduct conference at Project site. Incorporate keying conference decisions into final keying requirements.

J. Mockups: Construct mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Construct mockups of the cabinet types, countertops, accessories, and service fittings indicated on Drawings:
   2. Coordinate and incorporate other laboratory equipment and accessories indicated on Drawings.
   3. Construct mockups of the following types of laboratory casework elements:
      a. Metal Laboratory Casework: Approximately 10 lineal feet of laboratory casework as follows:
         1) Base Cabinets (30-inch Wide Units): One door unit, one 4-drawer high unit, one sink base unit and one knee space.

2) Countertop: Epoxy resin countertop and splashes.
3) Accessories: Utility space framing, lab sink, lab service fittings (hot/cold water and eye-wash fittings), pegboard, and car-boy shelf.

4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

K. Preinstallation Conference: Conduct conference at Project site.

1.5 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Certificates
1. Manufacturer's Certificate of qualifications specified and finish on casework.
2. Contractor's Certificate of installer’s qualifications specified.
3. Safety glass meets requirements of ANSI Standard Z97.1.

C. Action Submittals:

1. Product Data: Manufacturers published information for each type of cabinet, shelving, laboratory casework system hardware, countertop, sink, casework accessory, and service fitting.

a. Include cabinet styles and dimensions, component dimensions, standard construction details, and joint details.
b. Show compliance with specified reference standards, testing by recognized agencies, and application of testing agency labels.
c. Include service fitting manufacturer’s product cut-sheets for each fitting type and finish. Use same designation as indicated on Drawings.
d. Manufacturers generic guide specifications will not be reviewed.

2. LEED Submittals:

   a. Certificates for Credit MR4.1: For products having recycled content, documentation indicating percentage by weight of post-consumer and pre-consumer recycled content.

      1) Include statement indicating costs for products having recycled content.

   b. Product Data for Credit EQ 4.4:

      1) For each composite-wood product used, documentation indicating that the bonding agent contains no urea formaldehyde.
      2) For each adhesive used, documentation indicating that adhesive contains no urea formaldehyde.

3. Shop Drawings: For laboratory casework. Show location of each item, dimensioned plans and elevations, large scale sections and details, and attachments to other work.

   a. Detail assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   b. Product Schedule: For laboratory casework types. Use same designations indicated on Drawings.
   c. Indicated details of anchoring casework to permanent building construction including locations of blocking, reinforcements and other supports required for installation of laboratory casework.
   d. Include locations of and clearances from adjacent walls, doors, windows, other building components.
   e. Include coordinated dimensions for laboratory casework, laboratory fume hoods, laboratory equipment and laboratory accessories specified in other Sections.
   f. Include rough-in information for mechanical, plumbing and electrical connections to laboratory casework systems.

Indicated duct, piping and electrical connections, and locations of access panels.

g. Wiring Diagrams: For power, signal, and control wiring.

h. For cylinder restraints: attachment to other work. Include plans, elevations, sections, details, and attachments to other work.

1) Detail assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2) Indicate mechanical, plumbing and electrical service connections required. Include roughing-in information for connections.

4. Samples: For each exposed product and for each color and texture specified.

a. Metal plate, 150 mm (six inch) square, showing chemical resistant finish, in each color.

b. Each type of cabinet material, finish and color.

c. Each type of countertop and sink material, finish and color.

d. Each type of hardware, drawer and door pulls.

e. Other materials requiring color selection.

5. Samples for Verification: Unless otherwise directed, approved full-size Samples may become part of the completed Work, if in an undisturbed condition at time of Substantial Completion. Notify Architect of their exact locations. If not incorporated into the Work, retain acceptable full-size Samples at Project site and remove when directed by Architect.

a. One full-size, finished base cabinet complete with hardware, doors, and drawers.

b. One full-size, finished wall cabinet complete with hardware, doors, and adjustable shelves.

c. One Sample each of hinged and sliding doors.

d. 6-inch- (150-mm-) square Samples for each type of countertop material.
e. One of each service fitting specified, complete with accessories and specified finish.
f. One of each type of sink and accessory item specified.
g. One of each type of hardware item specified.

D. Informational Submittals:
1. Coordination Drawings: drawn to scale, and coordinated with each other, using input from Installers of the items involved. Coordinate with requirements of Division 01 Section "Project Management and Coordination."
2. Product Certificates: For laboratory casework, from casework manufacturer, certifying that products furnished comply with requirements.
3. Casework Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory casework with requirements of specified product standard. Submit full documentation of test results with detailed description of test units and procedures, witnesses' results and appropriate drawings or photographs of test unit and procedures.

4. Work Surface Material Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating epoxywork surface materials comply with product standards and material performance requirements specified.

E. Close-Out Informational Submittals: Submit the following with project close-out documentation.
1. Maintenance data.
2. Operation and maintenance data.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Schedule delivery of laboratory casework so that spaces are sufficiently complete that material can be installed immediately following delivery.

B. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install laboratory casework until building is enclosed, utility roughing-in and wet work are complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during remainder of construction period.

B. Overhead soffits and ceiling grid shall be in place prior to casework installation.

C. Overhead lighting shall be installed and operational prior to casework installation.

D. Flooring required to be installed under laboratory casework shall be installed prior to casework delivery.
   1. Flooring materials shall extend into knee-space areas, equipment areas and base cabinets without cabinet floor/bottom.

1.8 COORDINATION

A. Coordinate layout and installation of framing and reinforcements for support of laboratory casework.

B. Coordinate installation of laboratory casework with installation of fume hoods and other laboratory equipment.

1.9 EXTRA MATERIALS

A. Furnish complete touchup kit for each type and color of metal laboratory casework provided. Include fillers, primers, paints, and other materials necessary to perform permanent repairs to damaged laboratory casework finish.

B. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Cabinet Mounting Clips and Related Hardware: Quantity equal to 5 percent of amount installed, but no fewer than 20 of each type.

C. Pegboard Pegs and Hole Covers: Quantity equal to 5 percent of the amount installed, but no fewer than 20 of each type/size.

D. Adjustable Shelving Units: Provide Quantity equal to 5 percent of each type and size.

1.10 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.

B. American Society for Testing and Materials (ASTM):

A36/A36M-08.....	Carbon Structural Steel
A167-99(R 2009).....	Stainless and Heat-Resisting Chromium Steel Plate Sheet and Strip
A283/A283M-03(R 2007)...	Low and Intermediate Tensile Strength Carbon Steel Plates
A568/A568M-09.....	Steel, Sheet, Carbon and High-Strength, Low-Alloy Hot-Rolled and Cold-Rolled, General Requirements
A794/A794M-09.....	Standard Specification for Commercial Steel (CS), Sheet, Carbon (0.16% Maximum to 0.25% Maximum) Cold Rolled

B456-03(R2009).....Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
C1036-06.....Flat Glass

C. American National Standard Institute:
Z97.1-09.....Safety Glazing Material used In Buildings

D. Builders Hardware Manufacturers Association (BHMA):
A156.1-06.....Butts and Hinges
A156.9-10.....Cabinet Hardware
A156.5-10.....Auxiliary Locks and Associated Products
A156.11-10.....Cabinet Locks
A156.16-02.....Auxiliary Hardware

E. American Welding Society (AWS):
D1.1-10.....Structural Welding Code Steel
D1.3-08.....Structural Welding Code Sheet Steel

F. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500-505-06 Series...Metal Finishes Manual

G. U.S. Department of Commerce, Product Standard (PS):
PS 1-95.....Construction and Industrial Plywood

H. Federal Specifications (Fed. Spec.):
FF-N-836D.....Nut, Square, Hexagon Cap, Slotted, Castle Knurled, Welding and Single Ball Seat
A-A-55615.....Shield, Expansion; Nail Expansion (Wood Screw and Lag Bolt Self-Threading Anchors)

I. Scientific and Furniture Association (SEFA):
SEFA-8 “Recommended Practices for Laboratory Grade Furniture, Casework, Shelving and Tables with SEFA-3 “Recommended Practices for Laboratory Work Surfaces.”

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Laboratory Casework, Movable Workstation and Shelving. Basis-of-Design Products: Subject to compliance with requirements, provide Kewaunee

Steel Casework for fixed cabinets and Kewanee Adjustabench for Mobile Casework or comparable product by one of the following:

1. Mott Manufacturing Ltd.
2. Thermo Scientific; Hamilton Laboratory Furniture and Fume Hoods.

B. Epoxy Resin Manufacturer: Subject to compliance with requirements, provide products by one of the following:

1. Durcon, Inc.
2. Kewaunee Scientific Corporation.
3. Thermo Scientific; Epoxyn Products.
4. Mott Manufacturing Ltd.

C. Water, Laboratory Gas and Electrical Service Fittings Basis-of-Design Products: Subject to compliance with requirements, provide Water Saver Faucet Co. products indicated on Drawingsor comparable product by one of the following:

1. Broen, Inc.
2. Chicago Faucet, a Geberit Company.

2.2 MATERIALS

A. Steel Materials:

1. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 25-percent.
2. Steel Sheet: Cold-rolled, commercial steel (CS) sheet, complying with ASTM A 1008/A 1008M; matte finish; suitable for exposed applications.

B. Epoxy Materials: Factory-molded, modified epoxy-resin formulation with smooth, nonspecular finish.

1. Physical Properties:
   a. Flexural Strength: Not less than 10,000 psi (70 MPa).

b. Modulus of Elasticity: Not less than 2,000,000 psi (1400 MPa).
c. Hardness (Rockwell M): Not less than 100.
d. Water Absorption (24 Hours): Not more than 0.02 percent.
e. Heat Distortion Point: Not less than 260 deg F (127 deg C).

2. Chemical Resistance: Epoxy-resin materialwhen tested with reagents according to SEFA-3 Work Surfaces Chemical/Stain Resistance Test, shall have no more than four Level-3 conditions.

3. Color: Dark GrayAs selected by Architect from manufacturer's .

C. Auxiliary Materials:

1. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
2. Sealants:

a. Sealant Joints and Penetrations in Work Surface Materials: Silicon sealant recommended by work surface manufacturer.
b. Between Laboratory Casework and Adjoining Construction: Refer to Division 7 Section "Sealants.

3. Glass for Glazed Doors: Clear tempered glass complying with ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality-Q3; not less than 5.0 mm thick.
4. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
5. Steel Tubing: ASTM A 500, cold-formed steel tubing.
6. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.
7. Utility-Space Framing: Steel framing units consisting of 2 steel slotted channels complying with MFMA-4, not less than 1-5/8 inches square by 0.105 inch/12 gage (2.7mm) nominal thickness, and connected at top and bottom by U-shaped brackets made from 1-1/4-by-1/4 inch steel flat bars. Framing units may be made by welding specified channel material into rectangular frames instead of using U-shaped brackets.

8. Slotted Channel Framing: Cold formed metal box channels (struts) complying with MFMA-4.

a. Structural Support Material: Cold-rolled steel, ASTM A 1001/A 1001M; structural steel, Grade 33; 0.105-inch/12 gage (2.7-mm) minimum thickness; coated with rust-inhibitive, baked-on acrylic enamel.

b. Channel Size: 1-5/8 inch square, except 7/8 inch by 1-5/8 inch units for miscellaneous pipe supports where indicated.

2.3 MANUFACTURED PRODUCTS

A. Manufacturer of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.

2.4 METAL CABINET FABRICATION

A. Cabinet Design:

1. Metal Cabinets: Flush overlay with square edgesexcept where required by manufacturer for special purpose cabinet types.

a. Provide 1/8-inch (3.2-mm) reveals between adjacent doors and adjacent drawers and between adjacent cabinets.

B. Metal Cabinet Construction: Cabinet performance shall comply with acceptance levels of physical performance tests in SEFA 8-M. Drawer cycle test shall comply with laboratory load (100 pound) and heavy-duty laboratory load (150 pound) acceptance level.

C. Fabrication: Assemble and finish units at point of manufacture. Use precision dies for interchangeability of like-size drawers, doors, and similar parts. Perform assembly on precision jigs to provide units that are square. Reinforce units with angles, gussets, and channels. Except where otherwise specified, integrally frame and weld cabinet bodies to form dirt and vermin-resistant enclosures. Where

applicable, reinforce base cabinets for sink support. Maintain uniform clearance around door and drawer fronts of 1/16 to 3/32 inch (1.5 to 2.4 mm).

1. Cabinets, General:

   a. Cabinets 30 inches and wider with pair of swinging doors shall be provide full access to complete interior without center vertical post.
   b. Provide reinforcing at front and rear corners with full upright posts containing shelf adjustment holes, maximum 1/2-inch on center.
   c. Provide floor mounted cabinets with leveler screws and integral bottom flange at each corner, accessed through openings in toe-space or cabinet bottom; plug openings.

2. Base Cabinets:

   a. Provide base cabinets with removable backs for access to utility space. Removable backs are not required at suspended cabinets, cabinets with security panels and where countertop depth is less than 30 inches.
   b. Provide sink base cabinets with partial height back panels to accommodate large sinks. Sink base cabinets to have locks, All locks are to be keyed to one master.
   c. Provide intermediate rails between drawers and doors, and between drawers with security panels.
   d. Intermediate rails shall be removable to allow modification to cabinet configuration in future.
   e. Base cabinet assemblies without cabinet bottom separating interior of cabinet from toe-space are not acceptable.

3. Wall Cabinets:

   a. Provide wall cabinets with flush bottom.

4. Tall Cabinets:

a. Provide with toe-space.

D. Flush Doors: Outer and inner pans that nest into box formation, with full-height channel reinforcements at center of door. Fill doors with noncombustible, sound-deadening material.

E. Glazed Doors: Hollow-metal stiles and rails of similar construction as flush doors, with glass held in resilient channels or gasket material.

F. Hinged Doors: Mortise for hinges and reinforce with angles welded inside inner pans at hinge edge. Doors shall close against rubber bumpers.

G. Drawers: Fronts made from outer and inner pans that nest into box formation, with no raw metal edges at top. Sides, back, and bottom fabricated in one piece with rolled or formed top of sides for stiffening and comfortable grasp for drawer removal. Drawers shall close against rubber bumpers.

H. Pull-Boards: Outer and inner pans that nest into box formation, with no raw metal edges at front and top, with full-length channel reinforcement at center of pull-board. Fill pull-board with noncombustible, sound-deadening material. Front of pull-board in closed position to be flush with face of cabinet.

I. Pull-Out Shelves: Pan type with front, back and sides formed up, nominal 2-1/2 inch high, hemmed edges.

1. Shelves to be adjustable at 1/2-inch centers.
2. Front edge of shelf to be within 1 inch of inside face of door.

J. Adjustable Shelves: Front, back, and ends formed down, with edges returned horizontally at front and back to form reinforcing channels.

1. Shelves to be adjustable at 1/2-inch centers.
2. Reinforce shelves over 36 inches long with welded hat channel full length of shelf.

3. Front edge of shelf to be within 1 inch of inside face of door.
4. Cabinet Shelf Lip: Provide at cabinets without doors; steel angle 0.0478 inch/18 gage (1.21 mm) thick, horizontal leg attached to bottom front edge of shelf; top of vertical leg extending 1/2-inch above top of shelf.

K. Sloping Tops: provide sloping tops on cabinets where top of cabinet is 60 inches (1524 mm) or more above the finished floor. Slope tops 25 degrees or more and construct of same material and with same finish as cabinet. Provide sloping corner units, sloping filler and scribes, and closures at exposed end conditions.

L. Toe Space: Fully enclosed, nominal 4 inches (100 mm) high by 3 inches (75 mm) deep, with no open gaps or pockets.

1. Provide toe space at sides of cabinet at island and peninsula cabinets.

M. Utilities: Provide space, cutouts, and holes for pipes, conduits, and fittings in cabinet bodies to accommodate utility services and their support-strut assemblies. Grind edges and radius corners to eliminate sharp edges.

N. Filler and Closure Panels: Provide where indicated and as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets and with hemmed or flanged edges unless otherwise indicated.

1. Provide utility-space closure panels at spaces between base cabinets where utility space would otherwise be exposed, including spaces below countertops.
2. Provide closure panels at ends of utility spaces where utility space would otherwise be exposed.
3. Provide knee-space panels (modesty panels) at spaces between base cabinets, where cabinets are not installed against a wall or where space is not otherwise closed. Fabricate from back-to-back panels or of hollow construction to eliminate exposed hemmed or flanged edges.

4. Provide ADA compatible knee protection with removable panel at all ADA sinks as designated by Sxx42 on drawings.
5. Provide fixed and removable panels at knee-spaces. Incorporate electrical and data services fittings in fixed portion of knee-space panels where indicated.
6. Provide finished back of cabinet where exposed; conceal fasteners.

O. Security/Dust Panels: Provide security/dust panels above compartments unless located directly under tops.

1. Work Surface: As indicated on Drawings.

2.5 Shelving

A. Wall Rail System: Manufacturer's integrated system that includes support structure and cantilevered storage components mounted to building partitions.

1. Products: Subject to compliance with requirements, provide products by one of the following:

a. Kewaunee Scientific Corporation; Product - .Alpha System, Wall Hanging System.
b. Mott Manufacturing Ltd.; Product – Sigma Flex, Wall Rail System.
c. Thermo Scientific; Hamilton Laboratory Furniture and Fume Hoods; Product – Max/Lab, Wall Rail System.

2. System Assembly: Wall mounted rail systems with cantilevered storage components as indicated on Drawings.

a. Structural components consisting of vertical and horizontal rails anchored to building partitions.

1) Vertical Rails: Cold rolled steel channels, slotted for 1 inch (25 mm) adjustment of components; attached to horizontal rails and anchored to partition at 12 inches (300 mm) on-center, maximum. End vertical rails single

or double slotted; intermediate vertical rails double slotted.

2) Horizontal Rails: Cold rolled steel channels, slotted for 6 inch (150 mm) adjustment of vertical rails; anchored to partition at 12 inches (300 mm) on-center, maximum.

3) Horizontal Rail Covers: Cold rolled steel channel inserts, fastened to horizontal rails, between vertical rails.

b. Module Size and Configuration: As indicated on Drawings.

c. Fasteners: Type required by manufacturer for materials and assemblies being fastened.

d. Adjustable Shelving Units: Shelving material, number, size and configuration as indicated on Drawings.

e. Suspended Casework: Type and size as indicated on Drawings.

f. Insert Panels: Steel panels with mounting brackets and hardware, as indicated on Drawings.

g. Load Capacity: Minimum 760 lbs total load rating.

B. Adjustable Metal Shelving Units: Cold rolled steel, minimum 0.0478-inch/18 gage (1.21 mm) shelving units consisting of formed and welded sheet steel shelf units, intermediate stiffeners and shelf brackets.

1. Shelf Brackets: Cold rolled steel, bookend type with up-turned bracket welded to shelf to form integral unit; provide down-turned bracket for inverted top shelf where indicated on Drawings. Shelf bracket hooks to be compatible with slotted support system of bench-top upright system, wall rail system and mobile workstations; 1 inch (25 mm) adjustment.

2. Load Capacity: 180 lb. for shelf units up to 12 inch deep; 130 lb. for shelf units up to 18 inch deep; 100 lb. for shelf units up to 24 inch deep.

3. Shelf Lip: 1/2-inch (12 mm) high steel lip at unprotected edges of shelf; provide removable shelf lip at back of shelf when not adjoining partition or other shelf unit.

2.6 METAL FINISH

A. Prepare, treat and finish welded assemblies after assembling. Prepare, treat and finish , components that are assembled with mechanical fasteners before assembling. Prepare, treat and finish concealed surfaces same as exposed surfaces.

B. After fabrication of cabinet submerge in a degreasing bath, and thoroughly rinse to remove dirt and grease, and other foreign matter.

C. Chemical-Resistant Finish: Laboratory casework manufacturer's standard two-coat, chemical-resistant, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 1.5 mil average and 1.2 mil minimum on exterior and interior surfaces exposed to view; 1.2 mil average on backs of cabinets and other surfaces not exposed to view.

1. Ends of cabinets, including those installed directly against walls or other cabinets are defined as "exposed."
2. Chemical and Physical Resistance of Finish System: Finish shall comply with acceptance levels of cabinet surface finish tests in SEFA 8-M. Acceptance level for chemical spot test shall be no more than four Level 3 conditions, and results shall be within the range indicated for each chemical reagent.
3. Colors for Metal Laboratory Casework Finish: As selected by Architect from manufacturer's full range.
4. Finish resistant to action of the following reagents when 10 drops (0.5 cm^3) are applied to the surface and left open to the atmosphere for period of one hour.

Hydrochloric Acid 37 percent	Ethyl Alcohol
Phosphoric Acid 75 percent	Methylethyl Keytone
Sulfuric Acid 25 percent	Acetone
Glacial Acetic Acid	Ethyl Acetate
Sodium Hydroxide 10 percent	Ethyl Ether
Sodium Hydroxide (concentrated)	Carbon Tetrachloride
Ammonia Hydroxide (concentrated)	Xylene
Hydrogen Peroxide 5 percent	Phenol 85 Percent
Formaldehyde 37 percent	

D. Brass:
   1. U.S. Standard Finish No. 26 for hardware items.
   2. Other brass items: ASTM B456, chromium plated finish meeting requirements for Service Condition SCI.

E. Aluminum: Chemically etched medium matte, clear anodic coating, Class II, Architectural, 0.4 mils thick.

2.7 POWER OPERATED MOBILE WORKSTATIONS

A. Products: Subject to compliance with requirements, provide Kewaunee ADJUSTAbench for Power Operated Mobile Workstations or comparable product by one of the following:
   1. Thermo Scientific; Hamilton Laboratory Furniture and Fume Hoods; Product – Max/Mobile Power-Bench.
   2. Mott Manufacturing Ltd.

B. Power Operated Mobile Workstation: Manufacturer’s integrated system that includes mobile support structure, power operated height adjustable work surface, and storage component, designed for capacities indicated.
   1. System Assembly: Cart base, lifting columns, vertical uprights, cantilever table frame, work surface, suspended storage components

and accessories. Carts shall be self-supporting and independent of building structure.

a. Structural components consisting of cart base, lifting columns, vertical uprights, table frame for support of suspended casework and operator.
   1) Cart Base and Lifting Columns: Welded steel tubing and cold rolled steel, designed for cart size, configuration and loading requirements.
   2) Vertical Uprights: Removable, welded, cold rolled steel, designed for cart size and loading requirements indicated; slotted for 1 inch adjustment of table frame and other suspended components. Provide finished column caps for units indicated without uprights.
   3) Provide a shroud on the interior of one of the vertical uprights for wire management.
   4) Cantilever Table Frame: Welded cold rolled steel, designed for support of suspended casework and allow horizontal position adjustment. Provide leveling/locking studs at each leg member designed to engage upright and provide capability to adjust front edge of work surface (0.12- to 0.15-inch adjustment range).
   5) Operator: Power operated linear actuator and remote control designed to lift cantilever table frame and upright assembly. Locate push-button operator control at front edge of cantilever table frame. Equip unit with minimum 6-foot grounded power cord and plug for service indicated on Drawings.

b. Standard Duty Mobile Workstation:
   1) Lifting Capacity: Minimum 1,000 lbs. total load, including weight of work surface, suspended cabinets, shelving and contents.
   2) Table Frame Rating: Work surface plus 600 lbs.
   3) Work Surface Height Adjustment Range: Minimum 28-inch above floor; up to not less than 40-inch above floor.

c. Work Station Size and Configuration: As indicated on Drawings.

d. Work Surface: To match fixed casework.
e. Each work surface is to have two grommets for wire management.
f. End Caps: Plastic, color to match support structure.
g. Combination Leveler/Caster: Combination units with integral nylon wheel and screw-type height adjustable rubber foot.
    1) Standard Duty Instrument Carts: Zambus, Inc.; Product – Carrymaster Model AC-300F, combination caster with nylon wheel and screw-type height adjustable rubber foot.
h. Suspended Casework: Type and size as indicated on Drawings; match metal laboratory casework, finished front, sides and back, no toe base; two piece mechanical clamp brackets at front and two rear brackets.
i. Accessories: As indicated on Drawings.
j. Electrical Service:
    1) Equip unit with ground power cord and plug for service indicated on Drawings.
    2) Equip unit with two-cell raceway mounted under the bench top. The top cell is for data, and the bottom is for power. Provide duplex receptacles ganged at either end near grommet, density to be equivalent to one duplex every 18”.

2.8 LABORATORY SINKS

A. Sinks, General: Provide sizes indicated or manufacturer's closest standard size of equal or greater volume, as approved by Architect.

1. Outlets: Provide with strainers and tailpieces, NPS 1-1/2 (DN 40), unless otherwise indicated.
2. Overflows: For each sink except cup sinks, provide overflow of standard beehive or open-top design with separate strainer. Height 2 inches (50 mm) less than sink depth. Provide in same material as strainer.

B. Epoxy Sinks:

1. Sink Fabrication: Molded in 1 piece with smooth surfaces, coved corners, and bottom sloped to outlet; 1/2-inch (13-mm) minimum thickness.

    a. Provide with epoxy or polypropylene strainers and tailpieces.
    b. Provide sinks for drop-in installation with 1/4-inch- (6-mm-) thick lip around perimeter of sink.
    c. Provide integral sinks in epoxy countertops, bonded to countertops with invisible joint line.
    d. Provide manufacturer's recommended adjustable support system for table- and cabinet-type installations.

C. Cup Sinks: Material and size as indicated.

1. Provide epoxy cup sinks with polypropylene strainers and integral tailpieces.
2. Size: 3-by-9-inch (75-by-228-mm) oval.

2.9 ACCESSORIES

A. Pegboards (Drying Racks):

1. Basis-of-Design Manufacturer: Inter Dyne Systems, Inc.; Products as indicated below or comparable products from laboratory casework manufacturer.
    a. Epoxy Pegboards: Units with removable polypropylene pegs and stainless-steel drip trough with drain outlet.
    b. Basis-of-Design Product: Inter Dyne; Product – Epoxy Pegboard Model EPB-size as indicated on Drawings.
    c. Stainless steel drip trough mounted to bottom of pegboard; length of pegboard by 2 inch wide by 1 inch deep, with drain grid, drain outlet and 36 inch clear flexible drain tube.
    d. Pegs, other accessories and mounting as indicated on Drawings.

B. Gas Cylinder Brackets Products:

1. Manufacturers:

a. Matheson Tri-Gas; Products – Wall Mounted Cylinder Holder, Model No. 510-Wall and 510-C.
b. Safe-T-Rack Systems, Inc.; Product – Safe-T-Block Model No. CB-1 and CB-1C.
c. Troemner LLC.; Product – Gas Cylinder Wall Bracket, Model No. 715 and 717.

2. Wall Bracket: Cast aluminum wall bracket.
3. Safety Strap: Manufacturer's standard strap material, 1-inch wide with pinch- buckle clasp.
4. Secondary Chain: Manufacturer's standard chain and quick-release fitting.
5. Wall Bracket Assembly: Provide two wall brackets for each gas cylinder.
   a. Top bracket mounted maximum 35-inches above floor; unit with safety strap and secondary chain.
   b. Bottom bracket mounted 15-inches above floor; unit with safety strap.
   c. Anchor gas cylinder wall brackets to slotted-channel framing assemblies as indicated on Drawings. Refer to Division 5 Section "Metal Fabrications" for slotted-channel framing.
   d. Fasten cylinder bracket assembly to partition framing, blocking or reinforcement in partitions with fasteners spaced not more than 24 inches o.c.

2.10 HARDWARE

A. Factory installed.

B. Exposed hardware, except as specified otherwise, satin finished chromium plated brass or nickel plated brass or anodized aluminum.

C. Cabinet Locks:
   1. Provide locks as determined by user group.
   2. Locked pair of hinged door over 900 mm (36 inches) high:
      a. ANSI/BHMA A156.5, similar to E0261, Key one side.
      b. On active leaf use three-point locking device, consisting of two steel rods and lever controlled cam at lock, to operate by lever having lock cylinder housed therein.

c. On inactive leaf use dummy lever of same design.
d. Provide keeper holes for locking device rods and cam.

3. Door and Drawer: ANSI/BHMA A156.11 cam locks.
   a. Drawer and Hinged Door up to 900 mm (36 inches) high: E07261.
   b. Pin-tumbler, cylinder type lock with not less than four pins. Disc tumbler lock "duo A" with brass working parts and case, as manufactured by Illinois Lock Company are acceptable.
   c. Sliding Door: E07161.
4. Key locks differently for each type casework and master key for each lab.

   b. Provide two keys per lock.
   c. Provide six master keys per service.
5. Marking of Locks and Keys:
   a. Name of manufacturer, or trademark which can readily be identified legibly marked on each lock and key change number marked on exposed face of lock.
   b. Key change numbers stamped on keys.
   c. Key change numbers to provide sufficient information for manufacturer to replace key.

D. Cabinet Hardware: ANSI BHMA A156.9.
1. Door/Drawer Pulls: B02011.
   a. One for drawers up to 575 mm (23 inches) wide.
   b. Two for drawers over 575 mm (23 inches) wide.
   c. Sliding door flush pull, each door: B02201.
2. Door in seismic zones: B03352.
   a. Do not provide thumb latch on doors equipped with three point locking device.
   b. Use lever operated two point latching device on paired doors over 900 mm (36 inches) high if three point locking or latching device is not used.
3. Cabinet Door Catch:
   a. Install at bottom of wall cabinets, top of base cabinets and top and bottom of full height cabinet doors over 1200 mm (48 inches).
   b. Omit on doors with locks.
4. Drawer Slides:

a. Use B05051 for drawers over 150 mm (6 inches) deep.
b. Use B05052 for drawers 75 to 150 mm (3 to 6 inches) deep.
c. Use B05053 for drawers less than 75 mm (3 inches) deep.

5. Butt Hinges:
   a. B01351, minimum 1.8 mm (0.072 inch) thick chrome plated steel leaves.
   b. Minimum 3.5 mm (0.139 inch) diameter stainless steel pins.
   c. Full mortise type, five knuckle design with 63 mm (2-1/2 inch) high leaves and hospital type tips.
   d. Two hinges per door except use three hinges on doors 1200 mm (48 inches) and more in height. Use stainless steel leaves for tilting bin doors.
   f. Do not weld hinges to doors or cabinets.
6. Pivot hinges: ANSI/BHMA A156.1 A875B.
7. Shelf Supports:
   a. install in casework where adjustable shelves are noted.
   b. Adjustable Shelf Standards: B04061 with shelf rest B04081.
   c. Vertical Slotted Shelf Standard: B04102 with shelf brackets B04112 sized for shelf depth.
8. Sliding Doors:
   a. Doors supported by two ball bearing bronze or nylon rollers or sheaves riding on a stainless steel track.
   b. Sliding Door Tracks: B07093. Plastic tracks not acceptable.
   c. Doors restrained by a nylon, polyvinylchloride, or stainless steel guide at opposite end.
9. Auxiliary Hardware: ANSI A156.16.
10. Door silencers: LO3011 or LO3031.
    a. Install two rubber bumpers each door.
    b. Silencers set near top and bottom of jamb.
11. Labels Holders for Doors and Drawers:
    a. Cast or wrought brass or aluminum, 50 mm (2 inch) by 88 mm (3-1/2 inch).
    b. Fasten to casework as recommended by manufacturer.

2.11 WATER AND LABORATORY GAS SERVICE FITTINGS

A. Basis-of-Design Products: Subject to compliance with requirements, provide products by WaterSaver Faucet Co.; Products – As indicated on Drawings or comparable products by one of the following:
   1. Broen A/S.
   2. Chicago Faucet Company (The); a Geberit company.
   3. WaterSaver Faucet Co.

B. Service Fittings: Provide units that comply with SEFA 7, "Laboratory and Hospital Fixtures - Recommended Practices." Provide fittings complete with washers, locknuts, nipples, and other installation accessories. Include wall and deck flanges, escutcheons, handle extension rods, and similar items.

C. Materials: Fabricated from cast or forged brass unless otherwise indicated.
   1. Reagent-Grade Water Service Fittings: Polypropylene, PVC, or PVDF for parts in contact with water.

D. Finish:
   1. Polished chromium plated finish with clear epoxy coating.

E. Water Valves and Faucets: Provide units complying with ASME A112.18.1, with renewable seats, designed for working pressure up to 80 psig (550 kPa).
   1. Vacuum Breakers: Provide ASSE 1035 or 1001 vacuum breakers, as required by authorities having jurisdiction, on potable water fittings with serrated outlets.
   2. Aerators: Provide aerators in addition to serrated outlets on hot/cold water fittings; install aerators in lieu of serrated outlets where directed by Owner. Turn over un-used aerators and serrated outlets to Owner.
   3. Renewable Seat/Unit: Provide compression valve design with an integral adjustable volume control device. Unit shall be capable of converting from compression to self-closing control without disturbing the faucet body.
   4. Volume Control Setting: Verify setting with Owner.
   5. Self-Closing Valves: Provide self-closing valves where indicated.

6. Motion Sensor Valves: coordinate with Section 22 40 00 Plumbing Fixtures.

F. Needle Valves: Provide units with renewable, self-centering, floating cones and renewable seats of stainless steel or Monel metal.
1. Needle Valves: Provide units designed for maximum working pressure up to 125 psig (860 kPa).

G. Fine Control Needle Valves: Provide units designed for maximum working pressure up to 250 psig (1723 kPa).

H. Pressure Regulators: Provide where indicated.
1. Type: Non-relieving type with brass body and neoprene diaphragm.
2. Inlet Pressure Range: 5 to 300 psig.
3. Outlet Pressure Range: 5 to 125 psig.

I. Outlets:
1. Serrated hose end, unless otherwise indicated.
2. Quick connect fittings where indicated; keyed type by service.

J. Hand of Fittings: Furnish right-hand fittings unless fitting designation is followed by "L."

K. Remote-Control Valves: Provide needle valves, straight-through or angle type as indicated for fume hoods and where indicated.
1. Outlet Color: Comply with SEFA 7 for colors of valve handles to identify the service or media delivered.

L. Handles: Provide three- or four-arm, forged-brass handles for valves unless otherwise indicated.
1. Provide blade handles at water faucets, unless otherwise indicated.
2. Provide lever-type handles for ball valves unless otherwise indicated. Lever handle aligns with outlet when valve is closed and is perpendicular to outlet when valve is fully open.
3. Provide heat-resistant plastic handles for steam valves.
Provide knurled, molded plastic handles for pure water valves and pressure regulators.

4. Provide three- or four-arm molded plastic handles for remote control valves.
   a. Handle Color: Comply with SEFA 7 for colors of valve handles to identify the service or media delivered.

M. Service-Outlet Identification: Provide color-coded plastic discs with embossed identification, secured to each service-fitting handle to be tamper resistant. Comply with colors below and embossed identification.

Service	Color
Water	Dark Green
Air	Orange
Gas	Dark Blue
Vacuum	Yellow

2.12 ELECTRICAL SERVICE FITTINGS

A. Service Fittings, General: Provide UL listed units with metal housings, accessories, and gaskets required for mounting under laboratory casework. Receptacles, data outlets, switches, pilot lights, device plates, and accessories are specified in Division 26and 27 Sections.

1. Switch and Receptacle Colors: Refer to Division 26 Sections.
2. Data Outlets: Refer to Division 27 Sections.
3. Cover Plate Identification: Refer to Division 26 and 27 Sections.
4. Provide pilot light type switch with neon-light handle, illuminated when switch is “ON” for Fume Hood light switch, vacuum cabinet switch and where indicated.

PART 3 - - EXECUTION

3.1 COORDINATION

A. Before installing casework, verify wall and floor surfaces covered by casework have been finished.
B. Verify location and size of mechanical and electrical services as required.
C. Verify reinforcement of walls and partitions for support and anchorage of casework.

3.2 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of laboratory casework.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION OF CASEWORK

A. Comply with installation requirements in SEFA 2. Install level, plumb, and true; shim as required, using concealed shims. Where laboratory casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical. Do not exceed the following tolerances:
   1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet (1.5 mm in 3 m).
   2. Variation of Bottoms of Upper Cabinets from Level: 1/8 inch in 10 feet (3 mm in 3 m).
   3. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet (3 mm in 3 m).
   4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch (0.8 mm).
   5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch (1.5 mm).

B. Utility-Space Framing: Secure to floor with two fasteners at each frame. Fasten to partition framing, wood blocking, or metal reinforcements in partitions and to base cabinets.

C. Base Cabinets: Fasten cabinets to utility-space framing, partition framing, wood blocking, or reinforcements in partitions with fasteners spaced not more than 24 inches (600 mm) o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.
   1. Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 24 inches (600 mm) o.c. and at sides of cabinets with not less than 2 fasteners per side.

D. Tall, Upper and Wall Cabinets: Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through back, near top, at not less than 24 inches (600 mm) o.c.

E. Install shelving systems plumb and at heights to align shelf brackets for level shelves. Install shelving level and straight, closely fitted to other work where indicated.

F. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.

G. Adjust laboratory casework and hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

3.4 INSTALLATION OF COUNTERTOPS

A. Comply with installation requirements in SEFA 2. Abut top and edge surfaces in one true plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints only where shown on Shop Drawings.

B. Field Jointing: Where possible, make in same manner as shop-made joints using dowels, splines, fasteners, adhesives, and sealants recommended by manufacturer. Prepare edges in shop for field-made joints.

1. Use concealed clamping devices for field-made joints in plastic-laminate countertops. Locate clamping devices within 6 inches (150 mm) of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten according to manufacturer's written instructions to exert a uniform heavy pressure at joints.

C. Fastening:

1. Secure countertops, except for epoxy countertops, to cabinets with Z-type fasteners or equivalent, using two or more fasteners at each cabinet front, end, and back.
2. Secure epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than 48 inches (1200 mm) o.c.
3. Where necessary to penetrate countertops with fasteners, countersink heads approximately 1/8 inch (3 mm) and plug hole flush with material equal to countertop in chemical resistance, hardness, and appearance.
4. At utility chases behind base cabinets, provide utiity space framing material, wood blocking, cleats or other reinforcement to support edge of countertop at adjoining construction.

D. Provide required holes and cutouts for service fittings.

E. Provide scribe moldings for closures at junctures of countertop, curb, and splash with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.

F. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

3.5 INSTALLATION OF SINKS

A. Comply with installation requirements in SEFA 2.

B. Drop-in Installation of Epoxy Sinks: Rout groove in countertop to receive sink rim if not prepared in shop. Set sink in adhesive and fill remainder of groove with sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers.

C. Drop-in Installation of EpoxyCup Sinks: Rout groove in countertop to receive sink rim if not prepared in shop. Set sink in adhesive and fill remainder of groove with sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers.

3.6 INSTALLATION OF CASEWORK ACCESSORIES

A. Install accessories according to Shop Drawings, installation requirements in SEFA 2, and manufacturer's written instructions.

B. Securely fasten adjustable shelving supports, stainless-steel shelves, and pegboards to partition framing, wood blocking, or reinforcements in partitions.

C. Securely fasten umbilicals to countertop curbs and above ceiling supports, straight and plumb. Provide slot-channel framing to support ceiling shroud, independent of suspended ceiling.

D. Install shelf standards plumb and at heights to align shelf brackets for level shelves. Install shelving level and straight, closely fitted to other work where indicated.

E. Securely fasten pegboards to umbilicals, partition framing, wood blocking, or reinforcements in partitions.

3.7 INSTALLATION OF MOBILE WORKSTATIONS

B. Install mobile workstations according to Shop Drawings and manufacturer’s written instructions. Install level, plumb and true.

A. Install mobile work stations where indicated

3.8 INSTALLATION OF SERVICE FITTINGS

A. Comply with requirements in Divisions 22, 26 and 27 Sections for installing water and laboratory gas service fittings, electrical and data devices.

B. Install fittings according to Shop Drawings, installation requirements in SEFA 2, and manufacturer's written instructions. Set bases and flanges of sink- and countertop-mounted fittings in sealant recommended by manufacturer of sink or countertop material. Securely anchor fittings to laboratory casework unless otherwise indicated.

3.9 CLEANING AND PROTECTING

A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

B. Protect countertop surfaces during construction with 6-mil (0.15-mm) plastic or other suitable water-resistant covering. Tape to underside of countertop at a minimum of 48 inches (1200 mm) o.c.

3.10 PROTECTION TO FIXTURES, MATERIALS, AND EQUIPMENT

A. Tightly cover and protect cabinets against dirt, water chemical or mechanical injury.

B. Thoroughly clean interior and exterior of cabinets, at completion of all work.

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